CLAIMS

What is Claimed is:

1. A recyclable energetic composition for low temperature storage prepared by the process comprising:

mixture of at least one binder compound having at least one pendant azido group component with at least one plasticizer component, and thereafter said mixture is cooled to room temperature; and

at least one chain-extending diacetylene component, at least one crosslinking tri- or higher polyacetylene component, at least one metal, metallic, or non-metal fuel component, and at least one oxidizer component which are combined at or above room temperature, said diacetylene component(s) and said triacetylene component(s) are combined into said mixture without the aid of a solvent, said diacetylene component(s) is combined for a sufficient amount of time with said mixture before said triacetylene component(s) is combined with said mixture to produce longer oligomer chains on said binder(s), said triacetylene component(s), said metal, metallic, non-metallic fuel component(s), and said oxidizer component(s) are combined to produce a homogeneous composition wherein said composition is cured by chemically reacting said azido groups of said polymer binder(s) by cyclo-addition of said polyacetylene component(s) to form triazole linkages.

2. The energetic composition according to claim 1, wherein said mixture of said binder(s) and said plasticizer(s) components are combined at temperatures of at least approximately 100°F.

3. The energetic composition according to claim 1, further comprising at least one stabilizer component combined with said mixture at temperatures of at least approximately 100°F.

4. The energetic composition according to claim 1, wherein at least one said chain-extending diacetylene component and at least one said crosslinking triacetylene component are combined to said mixture while being heated.

5. The energetic composition according to claim 1, wherein at least one said diacetylene component comprises at least one dipropargyl isophthalate and/or dipropargyl terephthalate.

6. The energetic composition according to claim 1, wherein at least one said diacetylene component is selected from the group comprising at least one 1, 4-di-(cyanoethynyl) benzene and its isomers, 2,11 dodecanedione-1,12-dipropiolate, α, Ω-polyethylene glycol dipropiolate, aliphatic or aromatic organic compounds with two separated activated acetylenic moieties, or any combination thereof.

7. The energetic composition according to claim 1, wherein at least one said triacetylene component includes trimesic tripropargylate.

8. The energetic composition according to claim 1, wherein at least one said triacetylene component is selected from the group comprising trihydroxy compound

functionalized by esterification with propiolic acid to a triacetylene, tricarboxylic acid functionalized with propargyl alcohol, polycarboxylic acid or polyol having more than three acetylene groups, or any combination thereof.

9. The energetic composition according to claim 1, further comprising at least one stabilizer component dissolved in a volatile solvent and first combined with said plasticizer component(s) before combined with said binder(s) to prevent any decomposition of said plasticizer(s), and thereafter, said solvent is removed.

10. The energetic composition according to claim 1, wherein said binder is selected from the group comprising polyglycidyl azide (GAP), azidomethyl-methyl-oxetane (AMMO), *bis*(azido-methyl)oxetane/nitratomethyl-methyloxetane (BAMO/NMMO), *bis*(azido-methyl)oxetane/azidomethyl-methyl-oxetane (BAMO/AMMO), poly-nitratomethyl-methyl oxetane (poly-NMMO) and polyglycidyl nitrate (PGN) which have azido moieties added to the ends, copolymers, derivatives, and any combinations thereof.

11. The energetic composition according to claim 1, wherein said binder is selected from the group comprising conventional polyalkanes, hydroxyl-terminated polyalkanes, polyalkenes, polyethers, polyesters, copolymers, derivatives, and any combinations thereof with the hydroxyl end groups replaced or otherwise restructured to azido-groups.

12. The energetic composition according to claim 1, wherein said plasticizer is selected from the group comprising butanetriol trinitrate (BTTN), trimethyl-olethanetrinitrate (TMETN), triethyleneglycoldinitrate (TEGDN), diethyleneglycol-dinitrate (DEGDN), nitroglycerine (NG), *bis*(2,2-dinitropropyl)acetal/*bis*(2,2-dinitropropyl)formal (BDNPF/BDNPA), nitratoethylnitramine (alkyl NENA's), *bis*-(2,2-dinitropropyl) acetal/formal (BDNPF/A), polycyano-2-(difluoramino)-2,3-epoxyethane (PCDE) , *bis*(2,2-dinitro-2-fluoroethoxy) methane (FEFO), *bis*[2,2-*bis*(difluoramino)-5,5-dinitro-5-fluoropentoxy]methane (SYFO), 1,3-*bis*(fluorodinitroethoxy)-2,2-*bis*(difluoramino) propane (SYEP), 1,2,3-*tris*[1,2-*bis*(difluoramino)ethoxy]propane (TVOPA), acetyl triethyl citrate, dibutyl phthalate (DBP), dibutyl sebacate (DBS), dioctyl adipate (DOA), dioctyl azelate (DOZ), isodecyl pelargonate (IDP), triacetin, tributyrin, and any combination thereof.

13. The energetic composition according to claim 1, wherein said oxidizer component are dinitramide salt oxidizers including ammonium dinitramide (ADN) and/or potassium dinitramide.

14. The energetic composition according to claim 1, wherein at least one said oxidizer component is ammonium dinitramide (ADN).

15. The energetic composition according to claim 1, wherein said oxidizer component is further selected from the group comprising (Cl-20), polynitropolyacetylhexaaza-isowurtzitanes, (RDX), (HMX), (TEX), 3-nitro-1,2,4-triazol-5-one (NTO),

nitroguanidine (NQ), 1,3,5-triamino-2,4,6-trinitrobenzene (TATB), 1,3,3-trinitroazetidine (TNAZ), 1,1-diamino-2,2-dinitro ethane (DADNE), ammonium perchlorate (AP), ammonium nitrate (AN), hydroxylammonium nitrate (HAN), and any combination thereof.

16. The energetic composition according to claim 1, wherein said metal, metallic, non-metal fuel is selected from the group comprising aluminum, particulate aluminum, ultra fine aluminum, titanium, carbon black, graphite, boron, magnesium, zirconium, beryllium, lithium, zirconium, bismuth, their hydrides and carbides, and any combination thereof.

17. The energetic composition according to claim 1, wherein said metal fuel is selected from the group comprising aluminum, particulate aluminum Al^1, Al^2, Al^3, ultra fine aluminum, spherical aluminum, H-30, and any other aluminum particle sizes.

18. The energetic composition according to claim 1, wherein other solid propellant ingredients are added to the binder/plasticizer components including said oxidizer.

19. A method of making a recyclable energetic composition for low temperature storage comprising:

mixing at least one binder compound having at least one pendant azido group component with at least one plasticizer component;

heating said binder(s) and said plasticizer(s) mixture until the mixture is homogeneous;

cooling said mixture to room temperature;

adding at least one diacetylene component to said mixture without the aid of a solvent to produce longer polymer chains on said binder(s);

adding at least one metal, metallic, non-metal fuel, oxidizer component(s) to said mixture at room temperature; and

adding at least one tri- or higher polyacetylene component without the aid of a solvent to produce a homogeneous solid, elastomeric composition which is formed by chemically reacting said azido groups of said polymer binder(s) by cyclo-addition of said triacetylene component(s) to form triazole linkages.

20. The method according to claim 19, further comprising adding at least one stabilizer component to said mixture and while heating said mixture.

21. The method according to claim 19, further comprising at least one stabilizer component dissolved in a volatile solvent, combining said stabilizer to said plasticizer first before combining with said binder to prevent any decomposition of said plasticizer.

22. The method according to claim 19, wherein said diacetylene and said tri- or higher polyacetylene component are combined to the mixture while being heated.

23. The method according to claim 19, wherein said heating of said binder(s) and said plasticizer(s) mixture ranges from temperatures of about 100°F to about 130°F.

24. The method according to claim 19, further comprising adding other components to said energetic composition selected from the group comprising burn rate catalysts and modifiers, thermal, combustion and aging stabilizers, and opacifiers.

25. The method according to claim 19, wherein other solid propellant ingredients are added to the binder/plasticizer components including said oxidizer.

26. The energetic low temperature storage composition obtained by the process defined in claim 19.